

ASSOCIATIONS BETWEEN ORAL HEALTH KNOWLEDGE, LOCUS OF
CONTROL, AND CARIES STATUS

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A thesis submitted to the Faculty of the
Comprehensive Dentistry Graduate Program
Naval Postgraduate Dental School
Uniformed Services University of the Health Sciences
in partial fulfillment of the requirements for the degree of
Master of Science
in Oral Biology

June 2017

Naval Postgraduate Dental School
Uniformed Services University of the Health Sciences
Bethesda, Maryland

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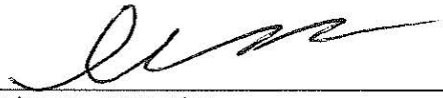
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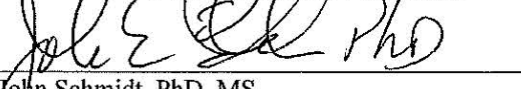
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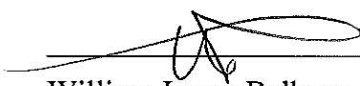

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ABSTRACT

ASSOCIATIONS BETWEEN ORAL HEALTH KNOWLEDGE, LOCUS OF CONTROL, AND CARIES STATUS

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Introduction: Patient intervention and knowledge play important roles in the management of oral chronic diseases such as caries. Understanding the dynamics of a person's behavior is a complex area of study that if better understood could result in improved oral health. Oral Health Knowledge (OHK) and Locus of Control are two measureable determinants that may affect Oral Health Status (OHS). The Survey of Oral Health Knowledge in Adults (SOHKA) was developed to comprehensively assess OHK and is being validated in this multi-phase study. This study explores the associations among OHK, Locus of Control, and caries status in active duty service members. To date, no study has evaluated the impact of Locus of Control and OHK on OHS.

Objective: To explore the associations among OHK and Locus of Control with oral caries status in active duty personnel.

Methods: Study questionnaires were completed by 201 subjects and included demographic/behavior, SOHKA, and Locus of Control specific for oral diseases. Dental records from 102 subjects were reviewed for caries risk.

Results: Oral health knowledge as measured by the SOHKA was not associated with caries risk status ($p>0.05$). Caries risk status was predicted by a Chance Locus of Control ($p=.037$).

Conclusion: Additional modification of SOHKA is required to establish associations among OHK, Locus of Control, and caries risk status. Utilizing Locus of Control and SOHKA may provide the potential to promote positive oral health behaviors and enhance the educational interventions and disease management that affect individual oral health and operational readiness.

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LIST OF ABBREVIATIONS

1. DMFT Decayed, Missing, Filled Teeth (permanent teeth)
2. NHANES National Health and Nutrition Examination Survey
3. IOM Institute of Medicine
4. CDC Center of Disease Control
5. ADA American Dental Association
6. NIH National Institute of Health
7. WHO World Health Organization
8. AMA American Medical Association
9. TOFHLA Test of Functional Literacy in Adults
10. TOFHLA-s Short version- Test of Functional Literacy in Adults
11. REALM Rapid Estimate of Adult Literacy in Medicine
12. REALD-30 Rapid Estimate of Adult Literacy in Dentistry-30
13. CMOHK Comprehensive Measure of Oral Health Knowledge
14. OHLi Oral Health Literacy
15. TOFHLiD Test of Functional Health Literacy in Adults Dentistry
16. SLT Social Learning Theory
17. LOC Locus of Control
18. HLC Health Locus of Control
19. MHLC Multidimensional Health Locus of Control
20. IHLC Internal Health Locus of Control
21. PHLC Powerful Others Health Locus of Control

22. CHLC	Chance Health Locus of Control
23. DHLC	Doctors Health Locus of Control
24. OHLC	Others Health Locus of Control
25. SOHKA	Survey or Oral Health Knowledge in Adults

CHAPTER I: INTRODUCTION

Dental caries is a destructive, chronic disease affecting teeth and the oral cavity. This disease affects function, esthetics and overall quality of life. In the adult population (age 20-64), 91% had dental caries and 27% had untreated caries. In adults aged 65 and older, over 96% had caries according to the National Health and Nutrition Examination Survey (NHANES). This data was collected between 2011-2012 (NHANES survey 2011-2012). This issue does not escape the military population either, in an evaluation of over 5,000 recruits at 9 installations in 2008, 72% needed fillings while 14% required seven or more fillings. A mean on 3.4 restorations was needed per new recruit (Leiendecker, Martin, & Ross, 2011). A study at the Naval Academy in 2012 showed that caries incidence increased significantly in all three caries risks groups (low, moderate, and high) while Midshipmen attended school. This included 25% who arrived at the Naval Academy disease free and developed caries by year four (Stratmeyer, 2016). Even with the introduction of fluoride into public drinking water in the 1940's and 1950's and the resultant decrease in dental caries as evidenced by many studies, the disease persists. One such study was carried out in Grand Rapids, Michigan that showed a nearly 60% decrease in the number of decayed, extracted, or filled teeth (DMFT) in children (Dean, Arnold, Jay & Knutson, 1956). In the 1990's there was a paradigm switch that led to a change from the surgical model to a disease prevention model when it comes to treating caries (Anderson, Bales, & Omnell, 1993). Other factors, such as health literacy, became important in understanding the determinants of oral health (Healthy People 2000).

Addressing health literacy and improving access to care have been the principle approaches to control oral health disease. Health Literacy is defined as “the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions” (Healthy People 2010). Research shows a positive correlation between low health literacy and poor health outcomes (Dewalt, Berkman, Sheridan, Lohr & Pigone, 2004). But why has a population of literate patients, such as midshipmen, who have unrestricted access to oral health care and have mandatory examinations started their military careers filling and caries free, but developed oral disease at a significant rate? Oral health knowledge is one factor that could be associated with disease status. Knowledge is defined as the understanding of a subject and the ability to use it for a specific purpose (Sharda & Shetty 2008). According to Brennan, “Knowledge of oral disease prevention should, in theory, underpin positive dental behaviors and result in better oral health outcomes” (Brennan, 2010). Unlike literacy, the association between oral health knowledge and oral health status is weak. This lack of relationship may be attributed to studies that assessed attitude rather than knowledge, specific focal populations (being mostly children), and questionnaires that were brief and not comprehensive (Citro, 2013). Knowledge could be important in improving health outcomes, however knowledge alone is insufficient. Behaviors are necessary to change and control oral health.

Behavior theories may also provide a better understanding of the determinants of preventive behavior and their effect on health status. One such theory is Locus of Control. Locus of Control is an expectancy-value theory where reinforcement or reward

are necessary for an individual to learn and utilize specific skills (Wallston, 1992). In 1994, Wallston created Multidimensional Health Locus of Control-Form C that was adapted to study specific disease entities (Wallston, 1994).

To date, no one has studied the associations between behavior, comprehensive knowledge, and the disease specific Locus of control for oral health status. A better understanding of this relationship may result in a better understanding of the determinants of oral health which could ultimately result in better oral health outcomes.

CHAPTER II: REVIEW OF LITERATURE

Health Literacy

Rootman described oral health literacy as, “the ability to access, understand, appraise, and communicate information to engage with the demands of health contexts to promote health” (Rootman, 2005). In Healthy People 2010, health literacy was defined as “the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions.” The American Dental Association’s Strategic Action Plan 2010-2015 discusses the importance of health literacy and its impact on health status, they say “limited health literacy skills are a stronger predictor of an individual’s health status than age, income, employment status, education level, and racial or ethnic group” (ADA, 2009). Poor health literacy relates to poorer performance of basic healthcare actions, an estimated 90 million people lack the literacy to perform basic healthcare actions costing between 60-230 million dollars annually to the United States healthcare system (Institute of Medicine, 2004).

Health literacy and its relationship to health status has been studied fairly extensively, however oral health literacy and oral health status has not. Low oral health literacy is hypothesized to be one of many barriers to optimal oral health care outcomes (NIDCR, 2005). Health literacy has mostly been measured three ways: Test of Functional Health Literacy in Adults (TOFHLA; Parker, Baker, Williams & Nurss, 1995) or short version (S-TOFHLA; Baker, Williams, Parker, Gazmararian & Nurss, 1999); Wide Range Achievement Test (WRAT4; Wilkinson & Robertson, 2006); and Rapid Estimate of Adult Literacy in Medicine (REALM; Davis, Long & Jackson, 1993). These tests

measure health literacy by word recognition, reading comprehension and pronunciation. In dentistry, the three most common measures of health literacy are modeled after these same tests used in medicine. They are the Test of Functional Health Literacy in Dentistry (TOFHLiD; Gong, 2007), and two versions of the Rapid Estimate of Adult Literacy in Dentistry (REALD-30 and REALD-99; Lee, Rozier, Lee, Bender, & Ruiz, 2007). A 2007 study of North Carolina patients in private practice found that 29% of patients scored below 22 on the REALD-30, which the authors defined as low oral health literacy (Jones, Lee & Rozier, 2007). Hom and colleagues (2012) administered the REALD-30 to 119 low-income patients who were pregnant for the first time; 23% of the participants' scores equated to low oral health literacy.

It is not fully understood by which mechanism oral health literacy affects oral health status. According to the Institute of Medicine, it is thought to involve poor foundational knowledge for making decisions, poor understanding of how to even access care, and poor understanding on provider's part when it comes to communicating with patients in an appropriate manner (Institute of Medicine, 2011). Conceptual knowledge is an important component of oral health literacy, it directly influences good decision-making. The provider plays a vital role with good communication. It is these communication skills that translate decision-making into action (Macek & colleagues, 2010).

Only a weak relationship has been established between knowledge and oral health status (Citro, 2013), even though knowledge appears to play a large role in oral health literacy models. Macek and colleagues (2010), Baker (2006), and others (Paasche-Orlow

& Wolf, 2007; Ryan, 2009) have shown that knowledge is a factor linked with improving a patient's health outcome.

Knowledge

Knowledge is defined as the “understanding of a subject with the ability to use it for a specific purpose” (Sharda & Shetty 2008). According to Brennan, “Knowledge or oral disease prevention should, in theory, underpin positive dental behaviors and result in better oral health outcomes” (Brennan, 2010).

According to the National Institute of Dental and Craniofacial Research, among U.S. adults, 75% did not know the purpose of dental sealants and could not identify any signs of oral cancer, and nearly 33% did not know the purpose of water fluoridation (NIDCR, 2005). Sabbahi and colleagues (2009) found that, even in a population with high oral health literacy, oral health knowledge was poor. They administered a 17-item Oral Health Knowledge Test (OHKT) to 100 adult patients in the faculty practice at the University of Toronto. Investigators asked subjects to match pictures of oral structures, oral diseases, dental fillings, a dental prosthesis, and oral hygiene aids with the correct word. 97 patients had adequate functional health literacy as measured by TOFHLA, 89 had adequate oral health literacy as measured by the OHLI, but only 35 had adequate oral health knowledge (Sabbahi & colleagues, 2009).

Jones and colleagues studied oral health literacy among an adult population (n=101) in North Carolina. The survey contained the REALD-30, REALM, and a 23-question section measuring components of health literacy to include dental knowledge. Patients who missed one or more questions regarding dental caries or periodontal disease

were six times more likely to have low literacy than those who answered all questions correctly. They concluded that an increase in oral health knowledge showed an overall improvement in a person's oral health literacy and a person with increased health literacy is more capable of grasping complex oral health knowledge (Jones, Lee & Rozier, 2007).

Oral Health Behavior

The interaction between oral health knowledge and oral health behaviors is complex. Patients require good foundational knowledge to affect behaviors and thus improve their oral health outcomes. Several studies have indicated that attitude and behavior are more important than knowledge in predicting disease prevention-related behavior change. In 2008, Sharda & Shetty had 182 dental students take a questionnaire in their first year and in their final year of school. The study found that there was over a 30% increase in knowledge between the students first and final years but there was less than an 8% gain in students who reported using fluoridated toothpaste and flossing. Even with the student's large gain in knowledge, there was only a minimal improvement in oral health behaviors (Sharda & Shetty, 2008).

The primary approach to increase awareness of the importance of oral hygiene behaviors and increase oral health status at the individual level is preventive education. In a study of 600 Floridians aged 65 or older were interviewed to identify the characteristics of individuals who survived into old age with an intact or nearly intact dentition. They found that persons with total or partial tooth loss reported less frequent dental care, less ability to pay dental care fees, less frequent oral hygiene, and were more likely to have been smokers or diabetic. Persons with tooth loss also had less positive attitudes towards

dentists and dental care in general. These findings suggest that tooth loss is the result of disease-, behavior-, and attitude-related causes, and/or their interactions (Gilbert & colleagues, 1993).

Social Learning Theory and Locus of Control

Rotter first described the social learning theory in 1954. It describes how “a reinforcement acts to strengthen an expectancy that a particular behavior or event will be followed by that reinforcement in the future” (Rotter, 1954). In 1966, he went on to describe these generalized expectancies as being either internal or external control of reinforcement. That is to say, the person either believes the reinforcement or reward is a result of their own actions or the actions of others. This generalized expectancy can be applied by an individual to all circumstances (Rotter, 1966).

Wallston and colleagues felt that a specific Health Locus of Control (HLC) scale would be necessary to predict specific behaviors. In this case, they wanted to measure whether an individual believed their health outcome was controlled by internal or external expectancies (Wallston, 1976). In 1994, they introduced the Multidimensional Health Locus of Control-Form C (MHLC-Form C) which allowed them to not only study disease-specific expectancies, but it also allowed them to further subdivide individuals into three groups: Internal (IHLC), powerful others (PHLC), and chance (CHLC). PHLC gets further subdivided into doctors (DHLC) and others (OHLC). An IHLC believes that they control their health outcome. A PHLC believes that a doctor controls their health outcome. A CHLC believes that neither they nor the doctor controls their health outcome any more than if it were left to chance (Wallston, 1994). In India in 2012 a study was

conducted among 462 12- and 15-year old individuals to determine what effects health locus of control had on oral health. The individuals were given an 11-item health locus of control (HLC) questionnaire. Based on the results from the questionnaire, they were classified as either having internal or external locus of control. Data were collected on the individuals oral hygiene levels and their caries experience. The results of the study showed that the individuals with higher external scores were more prone towards poor oral hygiene and increased caries levels. Individuals with an internal locus of control were more likely to engage in positive health behaviors and had lower levels caries overall. There was a significant positive correlation noted between external locus of control and DMFT scores, while a significantly negative correlation was found between internal locus of control and DMFT scores (Singh & Purohit, 2012).

CHAPTER III: MATERIALS AND METHODS

Methodology

This study will survey current active duty personnel to assess the level of their knowledge of oral health utilizing a recently developed SOHKA, and correlate that knowledge with (1) their recent history of dental caries, (2) their oral health-related behaviors and (3) their current risk of dental caries. Individual risk status for dental caries was collected in accordance with US Navy Bureau of Medicine and Surgery Instruction 6600.16a (Oral Disease and Risk Management Protocols in the Navy Medical Healthcare System, Appendix A).

Additionally, active duty personnel were surveyed for health locus of control and correlate locus of control with (1) their level of knowledge, (2) their oral health-related behaviors, (3) their recent history of dental caries, and (4) their current risk of dental caries.

The study consists of Phase I (pilot testing of the SOHKA to determine reliability and validity) and Phase II (validation of the SOHKA). Participants are active duty personnel. 201 volunteers were recruited during Phase I and up to another 556 more subjects will participate in Phase II. Subjects were recruited when they presented for annual dental examinations or treatment at the Primary Care Dental Clinic (PCDC), WRNMMC. Participants took the survey containing 15 demographic and self-reported behavior questions (Appendix B), the 28- SOHKA question (Appendix C), and the 18-question MHLC specific for oral health (Appendix D). We then reviewed 102 of the

participants' dental records to determine if either survey accurately predicted current oral health status, using the caries risk management protocol.

Study Design

Phase I – Pilot testing of the SOHKA to determine reliability and validity: 201 subjects were recruited to complete the study plan as described in the previous paragraph. Of the 201 subjects, 102 subject's records were reviewed and data was collected for disease status/risk. All other subjects were only administered the survey to collect SOHKA and MHLC data. Data was reviewed and the SOHKA survey will likely be revised (i.e. questions will be edited or deleted) prior to initiation of Phase II.

- In Phase I participants had the option to provide informed consent to complete the survey and have their dental record assessed for oral health risks or they could elect to simply complete the survey and not have their dental record assessed (no subjects chose the latter).
- During Phase I through WRNMMC PostMaster active duty members can also choose to complete the surveys online at a home/work computer (no subjects utilized this online method).

Phase II – Validation of the SOHKA: Up to 556 more subjects will provide informed consent to complete the study plan as described above using the revised version of the SOHKA.

Participants who provide informed consent during Phase I and Phase II will have their dental records abstracted for caries risk, and 3 years caries incidence utilizing the past three dental examinations.

Study Population, Inclusion and Exclusion Criteria

Subjects will be male and female active duty patients of the WRNMMC PCDC. All active duty personnel whose dental records are held at this facility will be eligible to participate in this study.

a. Inclusion Criteria

- 1) All male and female military active duty personnel whose dental records are held at WRNMMC PCDC were eligible to participate in this study.
- 2) Participants dental records must contain documentation of at least three annual dental examinations.

b. Exclusion Criteria

- 1) Subjects whose dental records are not held at WRNMMC Primary Care Dentistry.
- 2) Subjects whose dental records do not contain documentation of at least three annual dental examinations.
- 3) Subjects who participate in Phase I data collection will not be allowed to participate in Phase II.
- 4) Participants who participate at the PCDC will be asked to not complete the survey via the web-based link.

Sample Size Estimation

Phase I (pilot test, the present study): A sample of up to 312 subjects will be required to complete the SOHKA to allow for testing the internal consistency. Based on a 10:1 ratio of subjects: the number of questions for factor analysis, and a total of 28 questions in the SOHKA, 280 completed questionnaires will be required. To allow for a 10% dropout rate, up to 312 subjects will be surveyed. Complete data (i.e. health status from the dental record) will be collected for 100 consecutive subjects who complete the survey in the clinic in order to accrue at least 25 subjects who are at high dental caries risk (see chart below for assumptions)

Phase II (SOHKA validation, to be completed at a future date): To estimate the minimum number of subjects needed to detect an association between survey results and caries risk (rated as low, moderate, or high), the following distribution of subjects in risk categories is assumed based on past clinic experience.

	High Risk	Moderate Risk	Low Risk
Dental Caries	25%	45%	30%

A sample size of 85 subjects would have 80% power to detect a correlation coefficient of at least $r = 0.30$ between the SOHKA and caries risk status, however with a sample of 194 subjects statistical power rises to 90%. The outcome category with the fewest number of potential subjects is the caries high risk category. The expectation is that at least 25% of the sample will fall into this category allowing exploration of multiple factors that may be associated with high risk status. This number will be robust

enough to use a logistic regression analysis to test for predictors of high risk of periodontal disease. A properly developed model needs 10-20 subjects per predictive variable. A sample of 500 subjects would therefore provide 125 high risk subjects, allowing the assessment of up to 10-12 independent variables in a multivariate model for caries risk.

To allow for dropouts or incomplete medical records (e.g. ~10% loss rate), up to 556 subjects will be recruited for Phase II of this protocol (SOHKA validation, next phase of study to be completed at a future date). Based on current clinic caseload, there will be between 40-50 eligible subjects per clinic day, and therefore accruing up to 868 subjects (312 in Phase I + 556 in Phase II = 868 total subjects) is feasible.

Data Analysis Plan

1. For each phase (Phase I and Phase II) of the study, demographic and clinical characteristics of the sample of subjects in each Phase will be presented using means with standard deviations, medians with ranges or counts with proportions.
2. Phase I:
 - a. Data for the MHLC-Form C and SOHKA surveys were examined using factor analysis as well as Pearson's Chi-square and Fisher's exact test, and the range, mean and standard deviations were presented. Subscales for the SOHKA were explored (i.e. behavioral subscales and knowledge subscales) as well as total score. We explored possible subscales for the SOHKA (i.e. behavioral subscales and knowledge subscales) as well as a total score.

b. The MHLC-Form C survey results were scored for each subject on a scale from 6-36 for each of the three subscales for this survey: the IHLC, the CHLC and the PHLC. The PHLC is further categorized into two subscales scored from 3-18. These subscales for the PHLC are the OHLC and the DHLC. (see Appendix F for scoring methodology). Scores were summarized using means with standard deviations or medians with interquartile ranges.

c. Association of the MHLC-Form C subscales and SOHKA subscales were explored using Pearson's Chi-square test and Fischer's exact test. Association of the MHLC-Form C subscales and SOHKA subscales with caries risk status were explored using analysis of variance. Initial hypotheses will be generated from this pilot phase.

3. Phase II:

a. The MHLC-Form C and SOHKA surveys will be scored (subscales or a total score for the SOHKA will be determined from Phase I). We will generate descriptive statistics (mean, median, range) for each score by demographic characteristics (age groups, gender, race, education), tobacco use, caries risk status, and periodontal disease risk status.

b. For each most recent caries risk category (Low, Moderate, High), we will calculate the following:

Median (interquartile range (IQR) number of new caries lesions at each annual examination;

Median (IQR) three-year caries incidence;

Mean ($\pm$ SD) MHLC-Form C subscale scores and SOHKA survey scores (total, behavioral subscales and knowledge subscales). Scores in the three risk groups will be compared using analysis of variance.

Further, we will estimate associations between the MHLC-Form C and SOHKA survey scores and Gender, Age, Race, Education, and Behavior (brushing, flossing, tobacco use, and snack consumption) based on the two sample t-test and Pearson's or Spearman's correlation coefficient.

Data analysis is primarily exploratory given the low incidence of high risk caries. Multivariate analysis of significant demographic indicators for survey scores will be explored using linear regression. We will calculate Pearson's correlation coefficient to measure the level of agreement between MHLC-Form C and SOHKA survey scores. To explore the association of demographic and clinical variables, oral health knowledge survey results and locus of control survey results with oral health status (caries), ordinal logistic regression analysis will be used with a model using caries risk as the dependent variable. All statistical significance levels will be set at $\alpha = 0.05$. All data analyses will be completed using Statistical Package for the Social Sciences (SPSS) Version 18 software (SPSS, Inc., Chicago, IL).

Study Limitations: Given the fixed order of the surveys, it is possible that the last survey may have less complete responses. Also, generalizability of this research is limited based on the specific characteristics of the study population.

CHAPTER IV: RESULTS

From the information abstracted from 102 records and the data from the 201 surveys, a Fischer's exact test was run. The population consisted of 132 males and 69 females. Over half were officers (104) and 129 of them were aged 25-39. Oral Health Knowledge as measured by the SOHKA was not associated with caries risk status. The mean correct answers on the SOHKA for low caries risk group (n=64) was 19.80 (SD=3.8) and the mean correct answers for the moderate/high caries risk group (n=38) was 19.8 (SD=3.0); $F = .001$, $p = .979$. A Binary Logistic Regression model was run to determine predictors of caries risk status and it was found that a Chance Locus of control was a significant predictor (Odds Ratio: 1.113; 95% CI: 1.10-1.23; $p = 0.037$) (fig1 and 2). The next steps in analyses for these data is to run a factor analysis to determine which questions will be revised or dropped and replaced.

CHAPTER V: DISCUSSION

In the general population, 92% of adults experience dental caries and the problem is nearly as prevalent in the military population as well. This pilot phase of the study did not demonstrate that oral health knowledge was a determinant of caries. This result suggests that the SOHKA question items need further modification and refining to improve the validity of the overall measure. There were 8 questions out of the 28 included in SOHKA that over 90% of the population answered correctly regardless of their risk category. A factor analysis will be run and this should help determine how well the different questions in each construct area (etiology, prevention, risk factors, self-care) held together for each construct and whether there was any overlap between constructs by individual questions. This will then be used to determine which questions may then be revised or dropped and replaced as needed.

A Chance Locus of Control was shown to be a significant predictor of caries risk status. This indicates that leaving your oral health up to chance is associated with higher caries risk status. In other words, participants with higher caries risk status felt that neither they nor their dentist had as strong an impact on their oral health as chance. This finding could be of interest when a patient taking the survey is identified as having a high Chance Locus of Control. Such a patient could then be targeted for early intervention strategies centered around oral hygiene instructions and potentially more frequent exams.

The first phase of this study is still ongoing but initial results suggest that the survey will require some modification. If the survey can be shown to be reliable, the

second phase will commence. This second phase will correlate SOHKA with demographics, behavior, locus of control, and oral health status to determine its validity.

CHAPTER VI: CONCLUSION

Caries prevalence and risk is a significant oral health concern in the active duty military population. Having a valid and reliable short survey of oral health knowledge would be very useful to military dentists; however initial study results indicate the novel survey requires some modification. The next steps are to modify the survey based on factor analyses results and to re-evaluate the survey utility. The overall goal here is, if proven valid and the survey yields significant data, to create a screening tool that could identify patients at a higher risk for caries allowing for earlier intervention which could ultimately enhance patient care and improve operational readiness.

FIGURES

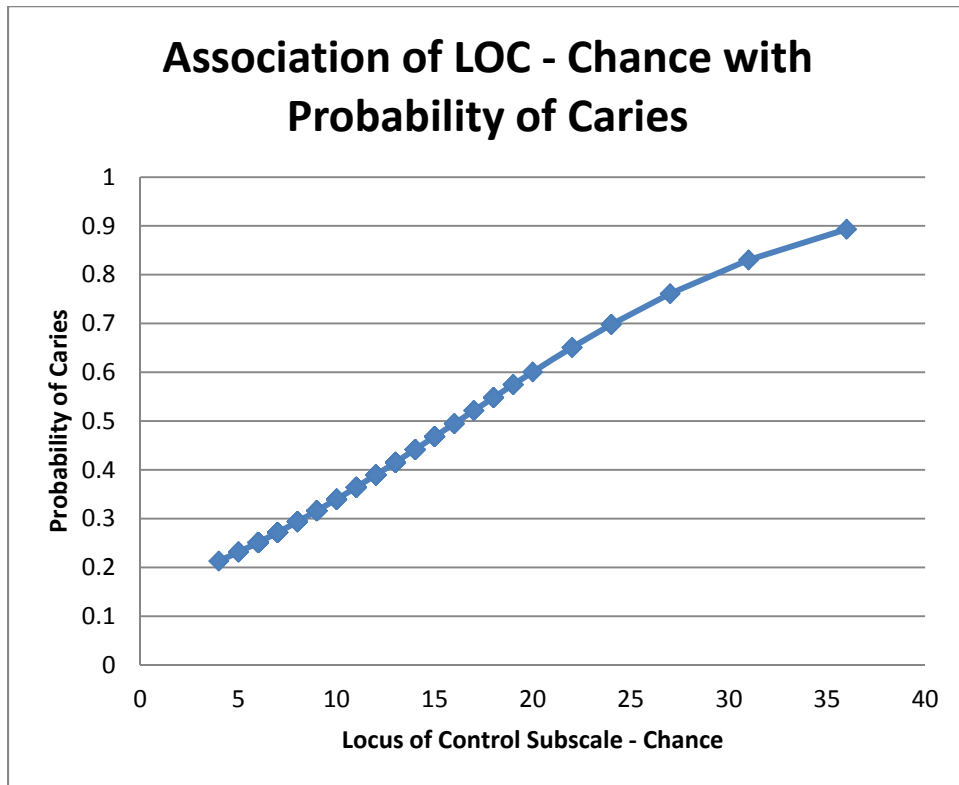


Figure 1 - Chance Locus of Control and probability of Caries

Variable	Odds Ratio	95% CI	p
Chance Locus of Control	1.113	1.01 – 1.23	.037

Figure 2 - Binary logistic regression model for Chance Locus of Control and high caries risk status

APPENDIX A: BUMED INSTRUCTION 6600.16A-Caries/Periodontal Risk

DENTAL CARIES RISK MANAGEMENT PROTOCOL

1. A Caries Risk Assessment will be performed on all active duty dental patients during the annual and periodic oral examination and recorded on the NAVMED 6600/13 Oral Exam. Patients will be classified as low, moderate, or high risk for future caries experience per the following Tri-Service criteria:

a. Low Caries Risk patients exhibit the following (must satisfy all criteria below):

(1) No new incipient or cavitated primary or secondary carious lesions during current exam.

(2) No factors that may increase caries risk. Factors increasing risk of developing caries may include, but are not limited to:

(a) Poor oral hygiene.

(b) Cariogenic diet.

(c) Presence of exposed root surfaces.

(d) Enamel defects or genetic abnormality of teeth.

(e) Many multisurface restorations.

(f) Restoration overhangs or open margins.

(g) Active orthodontic treatment.

(h) High titers of Cariogenic bacteria.

(i) Chemotherapy or radiation therapy.

(j) Eating disorders.

(k) Physical or mental disability with inability or unavailability of performing proper oral health care.

(l) Suboptimal fluoride exposure.

b. Moderate Caries Risk patients exhibit the following (demonstration of any single criterion necessitates an assessment of Moderate Caries Risk):

(1) One or two new incipient or cavitated primary or secondary carious lesions during current exam.

(2) No incipient or cavitated primary or secondary carious lesions during current exam but presence of at least one factor that may increase caries risk as outlined in paragraphs 1a(2)(a) through 1a(2)(l) above.

c. High Caries Risk patients exhibit the following (demonstration of any single criterion necessitates an assessment of High Caries Risk):

(1) Three or more new incipient or cavitated primary or secondary carious lesions during current exam.

(2) Presence of multiple factors that may increase caries risk as outlined in paragraphs 1a(2)(a) through 1a(2)(l) above.

(3) Xerostomia (medication-, radiation- or disease-induced).

2. Determination of caries risk classification will prompt treatment protocols specific to the risk category. Required educational and treatment protocols for each caries risk category are summarized in the following table on the next page, and must be uniformly implemented throughout Navy Dentistry.

CARIES RISK MANAGEMENT PROTOCOL FOR NAVY DENTISTRY

Low Caries Risk	Moderate Caries Risk	High Caries Risk
1. Oral hygiene Instruction. 2. Fluoride Dentifrice.	1. Oral hygiene instruction and oral disease education using this instruction, enclosure (7) as an outline. 2. Fluoride dentifrice. 3. Caries elimination a. Sealants for pits and fissures judged at risk. b. Incipient caries remineralization. 4. Identification of patient specific dietary modification (nutritional counseling). 5. Professional topical fluoride treatment (at 6 month interval); may be accomplished concurrently with restorative treatment). 6. Home fluoride rinses (OTC) or home fluoride treatments using prescription dentifrices, gels or pre-fabricated trays. 7. Discuss benefits of Xylitol chewing gum and provide a sample if available.	1. Oral hygiene instruction and oral disease education using this instruction, enclosure (7) as an outline. 2. Fluoride dentifrice. 3. Caries elimination a. Sealants for pits and fissures judged at risk. b. Incipient caries remineralization. 4. Identification of patient specific dietary modification (nutritional counseling). 5. Professional topical fluoride treatment (four applications over 6-12 months; may be accomplished concurrently with restorative treatment). 6. Home fluoride rinses (OTC) or home fluoride treatments using prescription dentifrices/gels or pre-fabricated trays. 7. Discuss benefits of Xylitol chewing gum and provide a sample if available. 8. Antibacterial mouth rinses. 9. Bacterial testing (if available). 10. Evaluation of salivary flow.
One Year Recall	6-12 Month Recall	3-Month Recall

APPENDIX B: DEMOGRAPHIC AND BEHAVIOR QUESTIONS

- 1) Currently Active Duty?
 - a. Yes
 - b. No

- 2) Continuously Active Duty for the past 36 months or longer?
 - a. Yes
 - b. No

- 3) Branch of service:
 - a. Army
 - b. Navy
 - c. Air Force
 - d. Marines
 - e. Coast Guard
 - f. Public Health Service
 - g. National Guard
 - h. N/A

- 4) Rank (or final rank if retired)
 - a. E1-E3
 - b. E4-E6
 - c. E7-E10
 - d. O1-O3
 - e. O4-O6
 - f. O7-O10
 - g. Non military

- 5) Age:
 - a. 16-18
 - b. 19-24
 - c. 25-39
 - d. 40-49
 - e. 50-64
 - f. 65 and older

- 6) Educational level:
- a. Less than high school
 - b. Some high school
 - c. High school graduate
 - d. GED or high school equivalency
 - e. Some college, less than 2 years
 - f. Associates degree
 - g. Some college, 2 or more years, no degree
 - h. Bachelors degree
 - i. Some postgraduate training, no degree
 - j. Postgraduate degree
- 7) Gender:
- a. Male
 - b. Female
- 8) What is your race/ethnicity? Please choose one or more
- a. White
 - b. Black or African-American
 - c. Hispanic or Latino
 - d. Asian
 - e. Native Hawaiian or other Pacific Islander
 - f. American Indian or Alaska Native
 - g. Other
- 9) Reason for today's visit:
- a. Annual exam
 - b. Hygiene appointment
 - c. Dental filling or other dental procedure appointment
 - d. Walk-in or sick call
- 10) How often do you brush your teeth?
- a. Less than 1 time per week
 - b. 1-2 times per week
 - c. Most days but not everyday
 - d. At least 1 time every day
 - e. More than 1 time every day

11) How often do you floss your teeth?

- a. Less than 1 time per week
- b. 1-2 times per week
- c. Most days but not everyday
- d. At least 1 time every day
- e. More than 1 time every day

12) Do you use tobacco products?

- a. Yes. I smoke cigarettes or cigars or a pipe
- b. Yes. I use smokeless tobacco
- c. No. I quit using tobacco products more than 3 months ago
- d. No. I quit using tobacco products less than 3 months ago
- e. No. I have never been a regular user or tobacco products

13) How often do you drink regular soda or eat sugary snacks between meals?

- a. Less than 1 time per week
- b. 1-2 times per week
- c. Most days but not everyday
- d. At least 1 time every day
- e. More than 1 time every day

14) Is your dental knowledge today greater than it was 3 years ago?

- a. Yes
- b. No
- c. I don't know

15) Is your oral hygiene better that it was 3 years ago?

- a. Yes
- b. No
- c. I don't know

APPENDIX C: SOHKA QUESTIONNAIRE

SURVEY OF ORAL HEALTH KNOWLEDGE IN ADULTS

*The following survey is designed to help us understand what people
know about their dental health.*

*All of the questions are true and false or multiple-choice. Please answer all questions
and it is appropriate to answer with the choice “I don’t know”.*

16) Bacteria that cause dental cavities can be spread from mother to child through contact with the mother's saliva by sharing food or kissing.

- a. True
- b. False
- c. I don't know

17) Stimulating saliva flow protects your teeth.

- a. True
- b. False
- c. I don't know

18) Snacks that are low in carbohydrates are less likely to cause dental cavities.

- a. True
- b. False
- c. I don't know

19) Snacks like carrots and apples are as likely to cause dental cavities as snacks such as cake and cookies.

- a. True
- b. False
- c. I don't know

20) Dry mouth, a side effect of many medications and chronic diseases, is a factor in

- a. Developing dental cavities.
- b. True
- c. False
- d. I don't know

21) Carbonated beverages that do not contain sugar (like Diet Coke) have no effect on teeth.

- a. True

- b. False
- c. I don't know

22) Which of the following does not cause dental cavities?

- a. table sugar
- b. fruit juice
- c. milk
- d. artificial sweetener
- e. corn syrup
- f. I don't know

23) Dental cavities usually grow beneath the surface of the teeth before becoming a hole on the surface.

- a. True
- b. False
- c. I don't know

24) Dental caries refers to

- a. The decay (caries) process
- b. The lesion that results from the decay process
- c. both a and b
- d. neither a and b
- e. I don't know

25) Which of the following practices most increases your risk of getting dental cavities?

- a. Sipping from a sugary soft drink all afternoon
- b. Drinking a sugary soft drink at a meal
- c. Both practices are equally risky
- d. I don't know

26) Drinking tap water containing _____ may protect your teeth from getting dental cavities.

- a. Fluoride
- b. Iron
- c. Vitamin C

- d. Vitamin D
- e. I don't know

27) Dental sealants prevent:

- a. food particles from getting in between the teeth
- b. teeth from getting stained
- c. gum disease
- d. dental cavities
- e. I don't know

28) The ideal time to get dental sealants is:

- a. When baby teeth first appear in the mouth
- b. When enamel on permanent teeth is fully visible above the gum line
- c. When enamel on permanent teeth has been visible above the gum line for 3-5 year
- d. I don't know

29) Tooth brushing reduces dental cavities by breaking up plaque above the gum line.

- a. True
- b. False
- c. I don't know

30) Tooth brushing with more force is a good practice because it leaves the teeth cleaner.

- a. True
- b. False
- c. I don't know

31) Flossing controls gum disease by breaking up plaque below the gum line.

- a. True
- b. False
- c. I don't know

32) If flossing makes your gums bleed, you should not floss.

- a. True
- b. False
- c. I don't know

33) The same kind of plaque that causes dental cavities causes gum disease.

- a. True
- b. False
- c. I don't know

34) Smoking tobacco affects oral cancer but not gum disease.

- a. True
- b. False
- c. I don't know

35) Smokeless tobacco has no effect on gum disease or dental cavities.

- a. True
- b. False
- c. I don't know

36) Gum disease may make it more difficult for a diabetic patient to control their blood sugar.

- a. True
- b. False
- c. I don't know

37) Gum disease may be more severe in people with poor nutrition.

- a. True
- b. False
- c. I don't know

38) Some orally transmitted viruses may cause oral cancer.

- a. True
- b. False
- c. I don't know

- 39) Stress may contribute to dental disease and mouth sores.
- a. True
 - b. False
 - c. I don't know
- 40) Expert tooth brushing is enough to prevent dental cavities and gum disease.
- a. True
 - b. False
 - c. I don't know
- 41) Skin replaces itself every 30 days. Soft tissue covering the inside the mouth replaces itself in 15 days.
- a. Both statements are true
 - b. The first statement is true, the second statement is false
 - c. The first statement is false, the second statement is true
 - d. Both statements are false
 - e. I don't know
- 42) Sinus congestion can cause toothaches.
- a. True
 - b. False
 - c. I don't know
- 43) Jaw muscle pain can cause toothaches.
- a. True
 - b. False
 - c. I don't know

APPENDIX D: MHLC FORM C-ORAL HEALTH QUESTIONNAIRE

Instructions: Each item below is a belief statement about your health condition with which you may agree or disagree. Beside each statement is a scale which ranges from strongly disagree (1) to strongly agree (6). For each item we would like you to select the number that represents the extent to which you agree or disagree with that statement. The more you agree with a statement, the higher will be the number you select. The more you disagree with a statement, the lower will be the number you select. Please make sure that you answer **EVERY ITEM** and that you select **ONLY ONE** number per item. This is a measure of your personal beliefs; obviously, there are no right or wrong answers

44	If my oral health worsens, it is my own behavior, which determines how soon I will get better again.
45	As to my condition, what will be, will be.
46	If I see my dental professional regularly, I am less likely to have problems with my oral health
47	Most things that affect my oral health happen to me by chance.
48	Whenever my oral health worsens, I should consult a dentally trained professional.
49	I am directly responsible for my oral health getting better or worse.
50	Other people play a big role in whether my oral health improves, stays the same, or gets worse.
51	Whatever goes wrong with my oral health is my own fault.
52	Luck plays a big part in determining how my oral health improves.
53	In order for my oral health to improve, it is up to other people to see that the right things happen.
54	Whatever improvement occurs with my oral health is largely a matter of good fortune.

55	The main thing, which affects my oral health, is what I myself do.
56	I deserve the credit when my oral health improves and the blame when it gets worse.
57	Following dentist's orders to the letter is the best way to keep my oral health from getting any worse.
58	If my oral health worsens, it's a matter of fate.
59	If I am lucky, my oral health will get better.
60	If my oral health takes a turn for the worse, it is because I have not been taking proper care of myself.
61	The type of help I receive from other people determines how soon my oral health improves.

APPENDIX E: MHLC FORM C-ORAL HEALTH QUESTIONNAIRE SCORING

SUBSCALE	POSSIBLE RANGE	ITEMS
Internal	6 - 36	44,49,51, 55,56,60
Chance	6 - 36	45,47,52, 54, 58, 59
Powerful Others	6 - 36	46,48,50, 53,57,61
Doctors	3 - 18	46,48,57
Other People	3 - 18	50,53,61

The score on each subscale is the sum of the values circled for each item on the subscale (i.e., where 1 = "strongly disagree" and 6 = "strongly agree"). No items need to be reversed before summing. All of the subscales are independent of one another.

APPENDIX F: DATA COLLECTION SHEET

Subject	1	2	3	4	5	6	7	8	...	500
Q1 *D										
Q2 *D										
Q3 *D										
Q4 *D										
Q5 *D										
Q6 *D										
Q7 *D										
Q8 *D										
Q9 *D										
Q10 *B										
Q11 *B										
Q12 *B										
Q13 *B										
Q14										
Q15										
New restorations needed year 1 caries										
New restorations needed year 2 caries										
New restorations needed year 3 caries										
Caries Risk Recent Exam										
Periodontal Risk Recent Exam										
Q16: 0 or 1										
Q17										
Q18										
Q19										
Q20										
Q21										
Q22										

Q23										
Q24										
Q25										
Q26										
Q27										
Q28										
Q29										
Q30										
Q31										
Q32										
Q33										
Q34										
Q35										
Q36										
Q37										
Q38										
Q39										
Q40										
Q41										
Q42										
Q43: 0 or 1										
Q44: 1-6										
Q45										
Q46 *Doc										
Q47										
Q48 *Doc										
Q49										
Q50 *Other										
Q51										
Q52										
Q53 *Other										
Q54										
Q55										
Q56										
Q57 *Doc										
Q58										
Q59										
Q60										
Q61 *Other										
Knowledge Score: Sum Q16-43										
Total IHLC 6-36: Sum-										

Q:44,49,51, 55,56,60										
Total CHLC 6-36: Sum- Q:45,47,52, 54, 58, 59										
Total PHLC 6-36: Sum- Q:46,48,50, 53,57,61										
Total DHLC 3-18 Sum- Q:46,48,57										
Total OHLC 3-18 Sim- Q:50,53,61										

APPENDIX G: INFORMED CONSENT

WALTER REED NATIONAL MILITARY MEDICAL CENTER (WRNMMC)
BETHESDA, MARYLAND

This consent form is valid only if it contains the IRB stamped date

Consent for Voluntary Participation in a Research Study Entitled:

Correlations between Oral Health Knowledge, Locus of Control, and Oral Health Status

Principal Investigator: CPT William J Belknap, DC, USA
Comprehensive Dentistry Resident
William.j.belknap8.Mil@Mail.Mil

Study site: ☒ WRNMMC, ☐ FBCH, ☐ USUHS, ☐ WRAIR, ☐ NMRC,
☐ JPC, ☐ OTHER

1. INTRODUCTION OF THE STUDY

You are being asked to be in this research study because you are active duty military and have had at least 3 annual dental exams in the military.

Taking part in this study is voluntary. You may choose either to take part or not to take part in the study. If you decide to take part in this study, you may leave the study at any time. No matter what decision you make, there will be no penalty to you and you will not lose any of your benefits to which you are otherwise entitled. Leaving the study will not affect your medical care. Please read the information below, and ask questions about anything you do not understand, before deciding whether to take part in the study.

If significant new findings develop during the course of this study that may relate to your decision to continue participation, you will be informed.

2. PURPOSE OF THE STUDY:

The purpose of this study is to explore any associations of oral health knowledge and oral health beliefs with oral health status. In other words, this research will help us learn more about what our patients know about oral health and if our patients think that self-care or professional care is more important for keeping our mouths healthy. To be in this study you must be active duty and have had at least 3 annual dental exams in the military.

Other studies have shown that knowledge and locus of control (how much control over your health you have or think you have) are associated with behavior and potentially oral health status. No studies to date have looked at these factors utilizing an oral health disease specific questionnaire for locus of control.

3. PROCEDURES TO BE FOLLOWED:

If you decide to participate, please answer all 61 questions on the Survey of Oral Health Knowledge in Adults, the Locus of Control survey plus some questions on gender, age, education, rank, time in the military, etc. It takes about 20 minutes to answer all 61 questions on the computer. Your answers are uploaded to Survey Monkey and will be only identified by an individual study ID number. If you saw this survey on WRNMMC Postmaster and decided to complete it, please do not do the survey again.

Please do not ask other people for answers, or look up answers on your portable devices or share the questions with friends and colleagues. For this survey to benefit everyone, we need to know the baseline knowledge people have about these questions and not have anybody complete the survey twice.

After the survey, we will look in your dental record for information about your past dental cavity and gum disease experience. That is why at the end of the consent we ask you for your name and last 4 digits of your social security number. This information will be matched with your study ID number on a master list, and then it will be removed from your consent document that the investigators keep. After the cavity and gum disease information is collected, your name and last 4 digits of your social security number will be saved on the master list until all participant data has been collected. Then the master list will be destroyed.

You can elect to only complete the survey and not have your dental decay and gum disease risks assessed in your dental record. Your participation in the research will be finished following completion of the online survey.

4. ALTERNATIVES TO PARTICIPATION:

Choosing not to participate in this study (completing the questionnaire) is your alternative to participating for the study.

5. AMOUNT OF TIME FOR YOU TO COMPLETE THE STUDY

You will be finished with this study following completion of the online survey. After you consent, completing the survey takes about 20 minutes.

6. NUMBER OF PEOPLE THAT WILL TAKE PART IN THIS STUDY

A total of 868 patients will be enrolled in this study. It is only being conducted here at Bethesda.

7. POSSIBLE RISKS AND DISCOMFORTS FROM BEING IN THIS STUDY

There is no known health risk associated with completing the survey. There is a possible privacy risk if master list that links your name and last 4 digits of your social security number were compromised. To prevent this from happening, the list containing this information will be protected by being kept in locked cabinets and on a password protected file on a CAC-enabled computer in the PI's office.

8. POSSIBLE BENEFITS FROM BEING IN THIS STUDY:

You may benefit from taking part in this study because your participation may increase your health knowledge. And your answers may help design future dental education programs that could improve dental health, reduce need for treatment, and save money. The information we collect may help us learn about further interventions to prevent and manage patients with dental disease.

However, no benefit can be guaranteed.

9. CONFIDENTIALITY/PRIVACY OF YOUR IDENTITY AND YOUR RESEARCH RECORDS

The principal investigator will keep your research records. These records may be looked at by staff from the Walter Reed (WRNMMC) Department of Research Programs, the Walter Reed (WRNMMC) Institutional Review Board (IRB), the DoD Higher Level Review, and other government agencies.

These duties include making sure that the research participants are protected. Confidentiality of your records will be protected to the extent possible under existing regulations and laws but cannot be guaranteed. Complete confidentiality cannot be promised, particularly for military personnel, because information bearing on your health may be required to be reported to appropriate medical or command authorities. Your research records may be disclosed outside of WRNMMC, but in this case, you will be identified only by a unique code number. Information about the code will be kept in a secure location and access limited to authorized research study personnel.

By signing this consent document, you give your permission for information gained from your participation in this study to be published in medical literature, discussed for educational purposes, and used generally to further medical science. You will not be personally identified; all information will be presented as

anonymous data. So, your name will not appear in any published paper or presentation related to this study.

This research study meets the confidentiality requirements of the Health Insurance Portability and Accountability Act (HIPAA).

10. CONDITIONS UNDER WHICH YOUR PARTICIPATION IN THIS STUDY MAY BE STOPPED WITHOUT YOUR CONSENT

Your taking part in this study may be stopped without your consent if remaining in the study might be dangerous or harmful to you. Your taking part in this study may also be stopped without your consent if the military mission requires it, or if you lose your right to receive dental care at a military hospital.

11. ELIGIBILITY AND PAYMENT FOR BEING IN THIS STUDY

You will not receive any payment for being in this study.

12. COMPENSATION IF INJURED AND LIMITS TO MEDICAL CARE

You will not receive any compensation (payment) if you are injured as a direct result of being in this study. You should understand that this is not a waiver or release of your legal rights. You should discuss this issue thoroughly with the study investigator before you enroll in this study.

Should you be injured as a result of your participation in this study, you will be given medical care for that injury at no cost to you.

Medical care is limited to the care normally allowed for Department of Defense health care beneficiaries (patients eligible for care at military hospitals and clinics). Necessary medical care does not include in home care or nursing home care. If you need to be hospitalized, you may have to pay the normal fees for subsistence (hospital meals), as per standard regulations.

If at any time you believe you have suffered an injury or illness as a result of participating in this research study, you should contact the Human Protections Administrator, Department of Research Programs, at Walter Reed National Military Medical Center at 301-295-8273.

13. COSTS THAT MAY RESULT FROM TAKING PART IN THIS STUDY

There is no charge to you for taking part in this study.

14. IF YOU DECIDE TO STOP TAKING PART IN THIS STUDY AND THE INSTRUCTIONS FOR STOPPING EARLY

You have the right to withdraw from this study at any time. If you decide to stop taking part in this study, you should tell the study investigator as soon as possible. By leaving this study at any time, you in no way risk losing your right to medical care and there will be no penalty to you and you will not lose any of your benefits to which you are otherwise entitled.

Should you choose to withdraw, you must tell the investigators that you do not want to complete the survey.

15. AUTHORIZATION FOR RESEARCH USE OF PROTECTED HEALTH INFORMATION

The Federal Health Insurance Portability and Accountability Act (HIPAA) includes a Privacy Rule that gives special safeguards to Protected Health Information (PHI) that is identifiable, in other words, can be directly linked to you. We are required to advise you how your PHI will be used. This authorization is effective until the end of the research study.

(1) What information will be collected?

For this research study, we will be collecting your name and the last 4 digits for your social security number so the investigators can match your dental decay and gum disease information from your dental record and the answers you provide on the survey.

(2) Who may use your PHI within the Military Healthcare System?

The members of the research team will have access to your health information in order to find out if you qualify to participate in this study, to administer research procedures, to monitor your progress, and/or to analyze the research data. Additionally, your PHI may be made available to groups such as the WRNMMC Department of Research programs and the WRNMMC Institutional Review Board.

(3) What persons outside of the Military Healthcare System who are under the HIPAA requirements will receive your PHI?

No data is expected to be shared.

(4) What is the purpose for using or disclosing your PHI?

PHI will be used to collect information about oral health status from your dental records.

(5) How long will the researchers keep your PHI?

The master list, linking your study number and personal identifying information, will be destroyed as soon as data collection is completed. This action de-identifies the data so that it cannot be linked to you. The research team at the Naval Post-graduate Dental School will keep de-identified data indefinitely.

This consent form and HIPAA authorization and individual data files will be maintained for a period of six years after the study is completed and then destroyed.

(6) Can you review your own research information?

You may look at your personal research information at any time before your identifiers are permanently removed from the data.

(7) Can you cancel this Authorization?

Yes. If you cancel this Authorization, however, you will no longer be included in the research study. The study information collected prior to this cancellation will be used by the research team. No further data will be collected.

If you want to cancel your Authorization, please contact the Principal Investigator in writing:

William J. Belknap
Naval Postgraduate Dental School
Walter Reed National Military Medical Center Building 1, 2nd Deck
8955 Wood Road
Bethesda, MD 20889-5628

(8) What will happen if you decide not to grant this Authorization?

If you decide not to grant this Authorization, you will not be able to participate in this research study. Refusal to grant this Authorization will not result in any loss of medical benefits to which you are otherwise entitled.

(9) Can your PHI be disclosed to parties not included in this Authorization who are not under the HIPAA requirements?

There is a potential that your research information will be shared with another party not listed in this Authorization in order to meet legal or regulatory requirements. Examples of persons who may access your PHI include representatives of the DoD Higher Level Review, the Food and Drug Administration, the Department of Health and Human Services (DHHS) Office for Human Research Protections (OHRP), and the DHHS Office for Civil Rights. This disclosure is unlikely to occur, but in that case, your health information would no longer be protected by the HIPAA Privacy Rule.

(10) Who should you contact if you have any complaints?

If you believe your privacy rights have been violated, you may file a written complaint with the WRNMMC Privacy Officer, located at 8901 Wisconsin Ave, Bethesda, MD 20889, Telephone: 301-319-4775.

Your signature at the end of this document acknowledges that you authorize WRNMMC personnel to use and disclose your Protected Health Information (PHI) collected about you for research purposes as described above.

16. CONTACTS FOR QUESTIONS ABOUT THE STUDY:

If you have questions about the study, or if you think you have a study-related injury you should contact CPT Belknap at 301-319-8231 or LCDR Ling Ye at 301-295-0565. For questions about your rights as a research subject, contact the Human Protections Administrator, WRNMMC Department of Research Programs in Building 17 at 301-295-8273 or WRNMMC Staff Judge Advocate Office at 301-295-2215.

A signed copy of this consent form will be given to you

SIGNATURE OF SUBJECT

You have read (or someone has read to you) the information in this consent form. You have been given a chance to ask questions and all of your questions have been answered to your satisfaction.

_____ Yes, I give the study team permission to access my dental record to assess my dental decay and gum disease risks. Initial _____

_____ No, I DO NOT give study team permission to access my dental record to assess my dental decay and gum disease risks. Instead I will only complete the survey. Initial _____

BY SIGNING THIS CONSENT FORM, YOU FREELY AGREE TO TAKE PART IN THE RESEARCH IT DESCRIBES.

Printed Name of Subject

Signature of Subject

Date

Time

SIGNATURE OF RESEARCH TEAM MEMBER OBTAINING CONSENT

My signature is intended to attest that the information in the consent document and any other information was explained to and apparently understood by the subject that questions and concerns were addressed and that informed consent was freely given.

Printed Name of Person Obtaining Consent

Signature of Person Obtaining Consent
subject)

Date (must be same as

Time

This sentence and the identifiers below will be removed from your consent as soon as the identifiers are entered on the master list.

Study #: _____

Your Name (please print): _____

Last 4: _____

APPENDIX H: PHASE I RECRUITMENT

“Correlations between Oral Health Knowledge, Locus of Control, and Oral Health Status”

This research will help us learn more about what our patients know about oral health and if our patients think that self-care or professional care is more important for keeping our mouths healthy. To be in this study you must be active duty.

Participation is voluntary. Not taking the survey is okay, and will not affect your access to treatment at this or any other treatment facility

Your participation may increase your health knowledge. And your answers may help design future dental education programs that could improve dental health, reduce need for treatment, and save money.

Please answer every question. Please do not ask other people for answers, or look up answers on your portable devices. Please do not share the questions with friends and colleagues. For this survey to benefit everyone, we need to know the baseline knowledge people have about these questions

If you choose to participate in the survey online please do not take the survey again while the research is being. Please share this link with other active duty personnel.

[Link](https://www.research.net/s/WRNMMCOraHealthPilot)

<https://www.research.net/s/WRNMMCOraHealthPilot>

If you have questions about the study, or wish to see the answers, or if you think you have a study-related injury, use this page to contact Dr. Belknap, the Principal Investigator, at 301-319-8231. For questions about your rights as a research subject, contact the Human Protections Administrator, WRNMMC Department of Research Programs in Building 17 at 301-295-8273 or the WRNMMC Staff Judge Advocate Office at 301-295-2215.

THANK YOU FOR YOUR TIME. IT IS GREATLY APPRECIATED!

APPENDIX I: DESIGNEE RECRUITMENT SCRIPT

"While you are waiting for your appointment to start, may I give you some information to read about a research project we are conducting? If you decide to participate in the study, it will take about 20 minutes of your time, which in most cases is less than the time you will spend waiting for your appointment to start. If today is not a good day, you can choose to come back on another day OR take the survey at home (only Phase I). This is a voluntary study, if you choose not to participate; it will not affect your dental care."

"Have you already participated in the online survey via Postmaster link or receiving a link from the Dental Readiness Clinic"

If subject will participate and has not taken survey yet:

- 1) Give participant a Study ID #
- 2) Have participant fill out patient information on half sheet from consent
- 3) Set subject up with laptop
- 4) "Please return laptop upon completion of online survey"

If subject does not want to take laptop survey(during Phase I)

"Would you be willing to take the survey online at a personal computer in the near future?" (Show patient Appendix H)

If subject says yes. "Please take survey only once, do not take survey with others, or share questions/answers with friends. However, please share this sheet with other active service members. We are looking for 280 participants to take this survey."

Immediate return half-sheets, Mi-Fi units, and laptops to CPT William Belknap in-person to secure items*

REFERENCES

- Acharya, S. & Sangam, D. (2008). Oral health-related quality of life and its relationship with health locus of control among Indian dental university students. *European Journal of Dental Education*, 12(4), 208-12.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211.
- Al-Ansari, J., Honkala, E., & Honkala, S. (2003). Oral health knowledge and behavior among male health sciences college students in Kuwait. *BMC Oral Health*. 7;3(1):2.
- Albert D, Barracks S, Bruzelius E, Ward A (2014). Impact of a Web-Based Intervention on Maternal Caries Transmission and Prevention Knowledge, and Oral Health Attitudes. *Maternal and Child Health Journal*, 18, 1765-1771.
- Altin S, Finke I, Kautz-Freimuth S, Stock S. (2014) The evolution of health literacy assessment tools: a systematic review. *BMC Public Health*, 14:1207
- American Dental Association: Council on Access, Prevention, and Interprofessional Relations. (2009). *Health Literacy in Dentistry Action Plan 2010-2015*. Chicago, IL: American Dental Association.
- American Medical Association. (2013) *Public Health: Health Literacy Program*, <http://www.ama-assn.org/ama/pub/about-ama/ama-foundation/our-programs/public-health/health-literacy-program.page>.
- Anderson M., Bales D., & Omnell, K. (1993). Modern management of dental caries: the cutting edge is not the dental bur. *Journal of American Dental Association*, 124(6), 36-44.
- Bader J., Rozier R., McFall, W. Jr, & Ramsey, D. (1990). Association of dental health knowledge with periodontal conditions among regular patients. *Community of Dental and Oral Epidemiology*, 18(1), 32-36.
- Baker, D. (2006) The meaning and the measure of health literacy. *Journal of General Internal Medicine*, 21(8), 878-883.
- Baker, D., Parker, R., Williams, M., & Clark, W. 1997. The relationship of patient reading ability to self-reported health and use of health services. *American Journal of Public Health*. 87(6), 1027-1030.
- Baker, D., Parker, R., Williams, M., Clark, W. & Nurss, J. (1997) The relationship of patient reading ability to self-reported health and use of health services. *American Journal of Public Health*, 87(6), 1027-30.

Bandura, A. (1994). *Self-efficacy*. In V. S. Ramachaudran (Ed.), *Encyclopedia of human behavior* (Vol. 4, pp. 71-81). New York: Academic Press. (Reprinted in H. Friedman [Ed.], *Encyclopedia of mental health*. San Diego: Academic Press, 1998)

Berkman, N., Sheridan, S., Donahue, K., Halpern, D., & Crotty, K (2011). Low health literacy and health outcomes: an updated systematic review. *Annals of Internal Medicine*, 155(2), 97-107.

Berkman, N., DeWalt, D., Pignone, M., Sheridan, S., Lohr, K., Lux, L., Sutton, S., Swinson, T., & Bonito, A. (2004). *Literacy and Health Outcomes. Evidence Report/Technology Assessment No. 87*, Rockville, MD: Agency for Healthcare Research and Quality.

Bobetsis, Y., Barros, S., & Offenbacher, S. (2006). Exploring the relationship between periodontal disease and pregnancy complications. *Journal of American Dental Association*, 137, Suppl:7S-13S.

Brennan, D., Spencer, J., & Roberts-Thomson, K. (2010). Dental knowledge and oral health among middle-aged adults. *Australian and New Zealand Journal of Public Health*, 34(5), 472-475.

Brown, L., & Swango, P. (1993). Trends in caries experience in US employed adults from 1971-1974 to 1985: cross sectional comparisons. *Advances in Dental Research*, 7(1), 52-60.

Burgler, M., White, K., Robinson, N. (2010). The role of self-efficacy in dental patients' brushing and flossing: Testing an extended Health Belief Model. *Patient Education and Counseling*, 78(2), 269-272.

Carnahan, T (1979). *The Development and Validation of the Multidimensional Dental Locus of Control*. Buffalo, NY: State University of New York at Buffalo.

Center for Disease Control and Prevention. (1990). *Healthy People 2000*. http://www.cdc.gov/nchs/healthy_people/hp2000.htm

Center for Disease Control and Prevention. (2010). *Healthy People 2020*. http://www.cdc.gov/nchs/healthy_people/hp2020.htm.

Chief, Bureau of Medicine and Surgery. Oral disease risk management protocols in the Navy military health system. Washington, DC: Department of the Navy Bureau of Medicine and Surgery, BUMED Instruction 6600.16A, 23 August 2010.

Citro, R.M. (2013). *Correlations between Oral Health Knowledge and Oral Health Status* (unpublished master's thesis). Uniformed Services University of the Health Sciences, Bethesda, MD.

- Cohen, L., Bonito, A., & Eicheldinger, C. (2011). Health literacy impact on patient-provider interactions involving the treatment of dental problems. *Journal of Dental Education*, 75(9), 1218-1224.
- Davis, T., Long, S., & Jackson, R. (1993). Rapid estimate of adult literacy in medicine: a shortened screening instrument. *Family Medicine*, 25, 391-5.
- Dean, H., Arnold, F., Jay, P., & Knutson J. (1950). Studies on mass control of dental caries through fluoridation of the public water supply. *Public Health Representative*, 65(43), 1403-1408.
- Dewalt, D., Berkman, N., Sheridan, S., Lohr, K., & Pignone, M. (2004). Literacy and health outcomes: a systematic review of the literature. *Journal General Internal Medicine*, 19(12), 1228-1239.
- Dickson-Swift V, Kenny A, Farmer J, Gussy M, Larkins S. (2014) Measuring oral health literacy: a scoping review of existing tools. *BMC Oral Health*, 14:148
- Dumitrescu, A., Wagle, M., Dogaru, B., & Manolescu, B. (2011). Modeling the theory of planned behavior for intention to improve oral health behaviors: the impact of attitudes, knowledge, and current behavior. *Journal Oral Science*, 53(3), 369-377.
- Edberg, M. (2006). *Essentials of Health Behavior: Social and Behavioral Theory in Public Health*. Boston, MA: Jones and Bartlett Publishers.
- Freeman R., Maizels J., Wyllie M., & Sheiham A. (1993) The relationship between health related knowledge, attitudes and dental health behaviours in 14-16-year-old adolescents. *Community of Dental Health*. 110(4), 397-404.
- Galgut, P., Waite, I., Todd-Pokropek, A., & Barnby, G. (1987). The relationship between the multidimensional health locus of control and the performance of subjects on a preventive periodontal programme. *Journal of Clinical Periodontology*, 14(3), 171-5.
- George A, Duff M, Johnson M, Dahlen H, Blinkhorn A, Ellis S, Ajwani S, Bhole S.(2014) Piloting of an oral health education program and knowledge test for midwives. *Contemporary Nurse*, 46(2), 180-186.
- Gilbert, G, Duncan, R, Crandall, L, Heft, M, & Ringleberg, M. (1993). Attitudinal and behavioral characteristics of older Floridians with tooth loss. *Community Dentistry and Oral Epidemiology*. 21. 384-389.
- Gong, D., Lee, J., Rozier, R., Pahel, B., Richman, J., & Vann, W. Jr. (2007). Development and testing of the Test of Functional Health Literacy in Dentistry (TOFHLiD). *Journal of Public Health Dentistry*, 67(2), 105-112.

- Hamilton, M. & Coulby, W. (1991). Oral health knowledge and habits of senior elementary school students. *Journal of Public Health Dentistry*, 51(4), 212-219
- Hollister, M.C., & Anema, M.G. (2004). Health behavior models and oral health: a review. *Journal of Dental Hygiene*, 78(3), 6.
- Hom, J.M., Lee, J.Y., Divaris, K., Baker, A.D., & Vann, W.F. Jr. (2012). Oral health literacy and knowledge among patients who are pregnant for the first time. *Journal of American Dental Association*, 143(9), 972-980.
- Horowitz, A., & Kleinman, D. (2012). Oral health literacy: a pathway to reducing oral health disparities in Maryland. *Journal of Public Health Dentistry*, 72(Suppl 1), S26-S30.
- Institute of Medicine. (2004) *Health Literacy: A Prescription to End Confusion*. National Academies Press. Washington D.C.
- Institute of Medicine. (2011). *Advancing Oral Health in America*. Washington, DC: The National Academies Press
- Jones, M., Lee, J., & Rozier, R. (2007). Oral health literacy among adult patients seeking dental care. *Journal of the American Dental Association*, 138(9), 1199-1208.
- Karim F, Begum J. (2014) Effect of Health Education on Oral Hygiene among the Smokeless Tobacco Users. *International Medical Journal*, 21(2), 226-229.
- Kneckt, M., Syrjälä, A., & Knuuttila, M. (1999) Locus of control beliefs predicting oral and diabetes health behavior and health status. *Acta Odontologica Scandinavica*, 57(3), 127-31.
- Kumar, Tadakamadla, S., Kriplani, D., Shah, V., Tadakamadla, J., Tibdewal, H., Duraiswamy, P., & Kulkarni, S. (2010). Oral health attitudes and behaviour as predisposing factor for dental caries experience among health professional and other professional college students of India. *Oral Health and Preventative Dentistry*, 8(2), 195-202.
- Lee, J.Y., Divaris, K., Baker, A.D., Rozier, R.G., Vann, W.F. (2012) The relationship of oral health literacy and self-efficacy with oral health status and dental neglect. *American Journal of Public Health*, 102(5), 923-929.
- Lee, J., Rozier, R., Lee, S., Bender, D., & Ruiz, R. (2007). Development of a word recognition instrument to test health literacy in dentistry: the REALD-30-a brief communication. *Journal of Public Health Dentistry*, 67 (2), 94-98.

Leiendecker TM, Martin GC, Moss DL, Mongeau SW, Chaffin JG, Dela Cruz GG. 2008 DOD Recruit Oral Health Survey. Tri-Service Center for Oral Health Studies, Uniformed Services University of the Health Sciences. <http://www.usuhs.mil/tscchs/pdf/2008DoDRecruitOralHealthSurvey.pdf>

Levin, L. & Shenkman, A. (2004). The relationship between dental caries status and oral health attitudes and behavior in young Israeli adults. *Journal of Dental Education*, 68(11), 1185-91.

Lin H., Wong M., Wang Z., & Lo E. (2001). Oral health knowledge, attitudes, and practices of Chinese adults. *Journal of Dental Research*, 80(5), 1466-70

Lu, H.X., Wong, M.C., Lo, E.C., & McGrath, C. (2013) Risk indicators of oral health status among young adults aged 18 years analyzed by negative binomial regression. *BMC Oral Health*, 13(1), 40.

Ludenia, K. & Donham, G. (1983). Dental outpatients: health locus of control correlates. *Journal of Clinical Psychology*, 39(6), 854-8.

Macek, M, Haynes, D., Wells, W., Bauer-Leffler, S., Cotton, P., & Parker, R. (2010). Measuring conceptual health knowledge in the context of oral health literacy: preliminary results. *Journal Public Health Dentistry*, 70(3), 197-204.

Measley, B. & Oates, T. (2006). Periodontal Inflammation and Diabetes Mellitus. *Journal of Periodontology*, 77(8), 1289-1303.

National Center for Education Statistics. (2006). *The Health Literacy of America's Adults: Results from the 2003 National Assessment of Adult Literacy*. Washington, D.C.: U.S. Department of Education

Dye, B, Thornton-Evans, G, Xianfen, L, & Iafolla, T. Dental Caries and Tooth Loss in Adults in the United States, 2011–2012. NHANES survey 2011-2012. <https://www.cdc.gov/nchs/products/databriefs/db197.htm>.

National Institute of Dental and Craniofacial Research, National Institute of Health, U.S. Public Health Service, Department of Health and Human Services. (2005). *The invisible barrier: literacy and its relationship to oral health*. A report of a workgroup sponsored by the National Institute of Dental and Craniofacial Research, National Institute of Health, U.S. Public Health Service, Department of Health and Human Services. *Journal of Public Health Dentistry*, 65(3), 174-182.

Nesse, W., Dijkstra, P., Abbas, F., Spijkervet, F., Stijger, A., Tromp, J., van Dijk, J., & Vissink, A. (2010). Increased prevalence of cardiovascular and autoimmune diseases in periodontitis patients: a cross-sectional study. *Journal of Periodontology*, 81(11), 1622-8.

- Nigg C., Allegrante J., & Ory M. (2002) Theory-comparison and multiple-behavior research: common themes advancing health behavior research. *Health Education Research*, 17(5), 670-709
- Noar, S.M., & Zimmerman, R.S. (2005). Health Behavior Theory and cumulative knowledge regarding health behaviors: are we moving in the right direction. *Health Education Research*, 20(3), 275-290.
- Odman, P., Lange, A., & Bakdash, M. (1984). Utilization of locus of control in the prediction of patients' oral hygiene performance. *Journal of Clinical Periodontology*, 11(6), 367-72.
- Ogawa, H., Soe, P., Myint, B., Sein, K., Kyaing, M., Maw, K., Oo, H., Murai, M., & Miyazaki, H. (2003). A pilot study of dental caries status in relation to knowledge, attitudes and practices in oral health in Myanmar. *Asian-Pacific Journal of Public Health*, 15(2), 111-117.
- Oliveira, E.R., Narendran, S., & Williamson, D. (2000) Oral health knowledge, attitudes and preventive practices of third grade school children. *Pediatric Dentistry*, 22(5), 395-400.
- Ory, M. G., Smith, M. L., Mier, N., & Wernicke, M. (2010). The science of sustaining health behavior change: The health maintenance consortium. *American Journal of Health Behavior*, 34 (6), 647-59.
- Osborn, C., Paasche-Orlow, M., Bailey, S., & Wolf, M. (2011). The mechanisms linking health literacy to behavior and health status. *American Journal Health Behavior*, 35(1), 118-128.
- Paasche-Orlow, M., & Wolf, S. (2007). The causal pathways linking health literacy to health outcomes. *American Journal Health Behavior*, 31(Suppl 1), S19-26.
- Parker, R., Baker, D., Williams, M., & Nurss, J. (1995). The test of functional health literacy in adults: a new instrument for measuring patients' literacy skills. *Journal of General Internal Medicine*, 10(10), 537-41.
- Pignone, M., DeWalt, D., Sheridan S., Berkman, N., & Lohr, K. (2005). Interventions to improve health outcomes for patients with low literacy: A systematic review. *Journal of General Internal Medicine*, 20(2), 185-192.
- Potter, L., & Martin, W. (2005). Health Literacy Fact Sheets. Center for Health Care Strategies: Hamilton, NJ.
- Prochaska, J., & Di Clemente, C. (1982). Transtheoretical therapy: Toward a more integrative model of change. *Psychotherapy*, 19(3), 276-288.

Research Activities. (2012). *Health literacy issues less of a problem for patients with dental versus medical conditions*. Agency for Healthcare Research and Quality, Rockville, MD. <http://archive.ahrq.gov/news/newsletters/research-activities/mar12/0312RA38.html>

Richman, J., Lee, J., Rozier, R., Gong, D., Pahel, B., & Vann, W. Jr. (2007) Evaluation of a word recognition instrument to test health literacy in dentistry: the REALD-99. *Journal of Public Health Dentistry*, 67(2), 99-104.

Ronis, D, Antonakos, C, & Lang, P. (2006). Usefulness of multiple equations for predicting preventive oral health behaviors. *Health Education Quarterly*, 23(4), 512-527.

Rootman, I & Ronson, B. (2005) Literacy and health research in Canada: Where have we been and where should we go? *Canadian Journal of Public Health*. 96: S62-S77.

Rosenstock, M (1966), Why people use health services. *Milbank Memorial Fund Quarterly*, 44(3), 94–127.

Rotter, J (1954). *Social learning and clinical psychology*. Englewood Cliffs, New Jersey: Prentice-Hall.

Rotter, J. (1966). Generalized expectancies for internal versus external control of reinforcement. *Journal of Educational Research*, 74(3): 185-190

Sabbahi, D., Lawrence, H., Limeback, H., & Rootman, I. (2009). Development and evaluation of an oral health literacy instrument for adults. *Community Dentistry and Oral Epidemiology*, 37(5), 451-62.

Sharda, A. and Shetty, S. (2008), A comparative study of oral health knowledge, attitude and behaviour of first and final year dental students of Udaipur city, Rajasthan, India. *International Journal of Dental Hygiene*, 6(4), 347–353.

Sharda, A. & Shetty, S. (2009). Relationship of periodontal status and dental caries status with oral health knowledge, attitude, and behavior among professional students in India. *International Journal of Oral Science*, 1(4), 196-206.

Singh, A & Purohit, B. (2012). Locus of Control and its association with Oral Health among 12 and 15 year olds in Bhopal City, Central India. *Journal of Behavioral Health*, 1(3), 189-195.

Slade GD. (1997). Derivation and validation of a short-form oral health impact profile. *Community Dentistry and Oral Epidemiology*, 25, 284-290.

Soderlund, K. (2013) ERs seeing increase of people visiting with dental problems. American Dental Association News: Chicago, IL. <http://www.ada.org/en/publications/ada-news/2013-archive/july/ers-seeing-increase-of-people-visiting-with-dental-problems>.

Sohn HA, Rowe DJ. (2015) Oral health knowledge, attitudes and behavior of parents of children with diabetes compared to those of parents of children without diabetes. *The Journal of Dental Hygiene*, 89(3), 170-179.

Staunton L, Gellert P, Knittle K, Sniehotta F. (2015). Perceived Control and Intrinsic vs. Extrinsic Motivation for Oral Self-Care: A Full Factorial Experimental Test of Theory-Based Persuasive Messages. *Annals of Behavioral Medicine*, 49, 258-268.

Stenström, U., Einarson, S., Jacobsson, B., Lindmark, U., Wenander, A., & Hugoson, A. (2009). The importance of psychological factors in the maintenance of oral health: a study of Swedish university students. *Oral Health and Preventative Dentistry*, 7(3), 225-33.

Stratmeyer M, Diefenderfer KM, Leiendecker TM. (2016). Retrospective assessment of caries experience among U.S. Naval Academy Midshipmen. *Journal of Public Health Dentistry*, 76(1), 47-55.

Suprabha, B.S., Rao, A., Shenoy, R., & Khanal, S. (2013) Utility of knowledge, attitude, and practice survey, and prevalence of dental caries among 11- to 13-year-old children in an urban community in India. *Global Health Action*, 30(6), 20750

Sun, X., Shi, Y., Zeng, Q., Wang, Y., Du, W., Wei, N., Xie, R., & Chang C. (2013). Determinants of health literacy and health behavior regarding infectious respiratory diseases: a pathway model. *BMC Public Health*, 22(13), 261.

U.S. Department of Health and Human Services. (2000). *Oral Health in America: A Report of the Surgeon General*. Rockville, MD: U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health.

Vamos C, Quinonez R, Gaston A, Sinton J. (2014) Addressing early preventive oral health care among young children: a pilot evaluation of the baby oral health program(bOHP) among dental professionals. *Journal of Dental Hygiene*, 88(4), 202-212.

Wallston, K. (1992). Hocus-pocus, the focus isn't strictly on locus: Rotter's social learning theory modified for health. *Cognitive Therapy and Research*, 16(2), 183-199.

Wallston, K. (2005) Overview of the special issue on research with the Multidimensional Health Locus of Control (MHLC) Scales. *Journal of Health Psychology*, 10, 619-621.

Wallston, K. (2005). The validity of the Multidimensional Health Locus of Control Scales. *Journal of Health Psychology*, 10, 623-631

Wallston, K., Stein, M., & Smith, K. (1994). Form C of the MHLC Scales: A condition-specific measure of locus of control. *Journal of Personality Assessment*, 63, 534-553

Wallston, K. & Wallston, B. (1981). *Health locus of control scales*. In H. Lefcourt (Ed.) *Research with the locus of control construct, Volume 1*. New York, NY: Academic Press.

Wallston, K., Wallston, B. & DeVellis, R. (1978). Development of the multidimensional health locus of control (MHLC) scales. *Health Education Monographs*, 6, 160-170.

Wallston, B., Wallston, K., Kaplan, G., & Maides, S. (1976). The development and validation of the health related locus of control (HLC) scale. *Journal of Consulting and Clinical Psychology*, 44, 580-585.

Wilkinson, G. S., & Robertson, G. J. (2006). *Wide Range Achievement Test 4 professional manual*. Lutz, FL: Psychological Assessment Resources

Williams, V., Baker, D., Honig, E., Lee, T., & Nowlan, A. (1998). Inadequate literacy is a barrier to asthma knowledge and self-care. *Chest.*, 114(4), 1008-1015.